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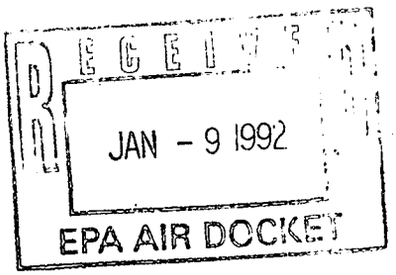
MEMORANDUM

TO: Will Smith/Dwight Atkinson

FROM: Jeff Kolb

SUBJECT: Summary of Results from MMT Analysis

DATE: January 7, 1992



This memorandum provides a summary of the results from our analysis of the effects of allowing MMT in gasoline.

We examined two scenarios for PADDs 1-4: (1) reformulated gasoline sold in seven specified non-attainment areas and in all the NESCAUM states[1]; and (2) reformulated gasoline sold in all locations, i.e., no conventional gasoline sales. Model runs for the winter months included the requirements for oxygenated gasoline. We configured the product slate and prices to conform to DOE's projections for 1995 ($24/bbl oil prices). We have not yet conducted an analysis for PADD 5 because our model is currently being modified so as to handle the California specifications for reformulated gasoline (specifically the T90 point and sulfur specs).

The major results are as follows:

- Use of MMT: MMT would be used in all types and grades of gasoline. However, it appears that it would not be used up to the proposed limit in premium gasoline (because of diminishing effects on octane, especially at high clear octane levels). Further, in the NESCAUM opt-in scenario, it appears that MMT would not be used to the full extent allowed in all grades of reformulated and oxygenated gasoline during the winter months. MMT use as a percent of the proposed limit, averaged over the entire gasoline pool and across seasons, is projected by our refinery model to be similar for an all conventional gasoline scenario and the NESCAUM opt-in scenario -- about 84 and 82 percent, respectively; and to be about 95 percent for the all reformulated gasoline scenario. Virtually all of the difference in the use of MMT is projected to occur during the winter months. (These results could change depending on the relative prices of crude oil, butane, aromatics, and MMT.)[2]

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[1] The NESCAUM states include: Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, New York, and New Jersey.

[2] Average MMT use in an all conventional gasoline scenario is projected to be slightly higher than that for the NESCAUM opt-in scenario during the winter season. The required use of oxygenates in reformulated and oxygenated gasolines reduces the marginal value of MMT. This reduces its use in such gasoline relative to conventional gasoline and reduces its average use in the entire gasoline pool by a small amount. As

- Refinery net revenues: At constant gasoline pool octane, the use of MMT would improve refinery annual net revenues in PADDS 1-4 (assuming no change in input and product prices) by about: $140 million for an all conventional gasoline scenario (with phase 2 RVP requirements); $160 million for the NESCAUM opt-in scenario; and $440 million for the all reformulated gasoline scenario. The value of MMT increases as the share of reformulated gasoline in the gasoline pool increases.[3] If refiners were required to offset a potential increase in VOC emissions of about 0.017g/m attributed to the use of MMT by reducing the average RVP of gasoline by 0.1 psi during the summer months, the improvement in net refinery revenues due to the use of MMT would decline during the summer months by about 15 percent for the NESCAUM opt-in scenario (about 9 percent over the entire year) and by about 6 percent for the all reformulated gasoline scenario (about 4 percent over the entire year).[4]

- Imports of crude oil and petroleum products: The use of MMT could reduce U.S. imports of crude oil and refined products to PADDs 1-4 by about 20,000 barrels per day for the NESCAUM opt-in case and by about 40,000 barrels per day for the all reformulated gasoline case.[5]

- Aromatics, benzene and olefin content: The model results indicate that the use of MMT would reduce the gasoline pool average of aromatics by about 1 percent point and of olefins by about 0.5 percent points during the summer for the NESCAUM opt-in scenario (it leaves benzene unchanged and would raise the olefin content by about 1 percent point during the winter). It would reduce the aromatics content by about one quarter percent point and raise the olefin content by the same amount during the summer for the all reformulated gasoline scenario (it leaves benzene unchanged and lowers aromatics and increases olefins in the winter by about a half percent point). These relatively small changes in the composition of gasoline could change as various assumptions regarding the prices of inputs, outputs, or refinery process capacity are altered in further analysis.

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discussed in footnote 3, when reformulated gasoline becomes a larger fraction of the gasoline pool MMT increases in value and its average use in the gasoline pool would be closer to the proposed limit.

[3] As the percentage of reformulated gasoline increases, refineries would reduce the production of high-octane reformates (which are high in aromatics) to meet the aromatics specification for reformulated gasoline and would substitute more costly high-octane blendstocks, such as isomerate and alkylate. MMT would enable refineries to use some less costly, lower octane blendstocks as replacements for reformate.

[4] Benzylacetone and methylbenzylacetone are co-antiknock compounds that increase the octane improvement from MMT roughly by a factor of two, according to U.S Patent No. 4,437,436 granted to Shell Oil Company on March 20, 1984. We have not investigated the possible effects on the refining industry of the use of such additives in combination with MMT.

[5] This represents the combination of reductions in crude oil inputs and increases (on a BTU weighted basis) of refined product outputs projected by the refinery model when MMT is allowed to be used in gasoline.

- Cost differential between the premium and regular grades of gasoline: The use of MMT would reduce the cost differential between the premium and regular grades of both conventional and reformulated gasoline by about 30 cents per barrel during the summer for the NESCAUM opt-in scenario. (There would be a smaller reduction of about 6 cents per barrel for all types of gasoline during the winter.) The use of MMT would reduce the cost differential between the premium and regular grades by about 80 cents per barrel during the summer and by about 60 cents per barrel during the winter for the all reformulated gasoline scenario. This possibly could lead to an increase in the octane level of premium gasoline or to an increase in the share of premium gasoline, offsetting somewhat the other effects outlined above.

- Types of refineries: We have not analyzed the differential effects of the use of MMT on refineries with different processing capabilities. It is likely that the value of MMT would differ among refineries. Less complex refineries that have more difficulty in generating octane probably would value it more highly. In addition, it is likely that the extent of use of MMT in various types and grades of gasoline would vary among refineries.

In general, the results of this analysis are consistent with those of analyses that we conducted in 1990 that were limited to examining effects on conventional gasoline.